

PG&E's Water/Energy Nexus Approach

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Agenda

- **Programs Overview**

- Selected water/energy nexus activities
- Water and Wastewater Programs
- Demand Response

- **Program Opportunities and Plans**

- Overview of 2013-2014 Water/Energy initiatives

- **Water Agency Partnerships**

Richard Harris, Manager of Water Conservation, EBMUD

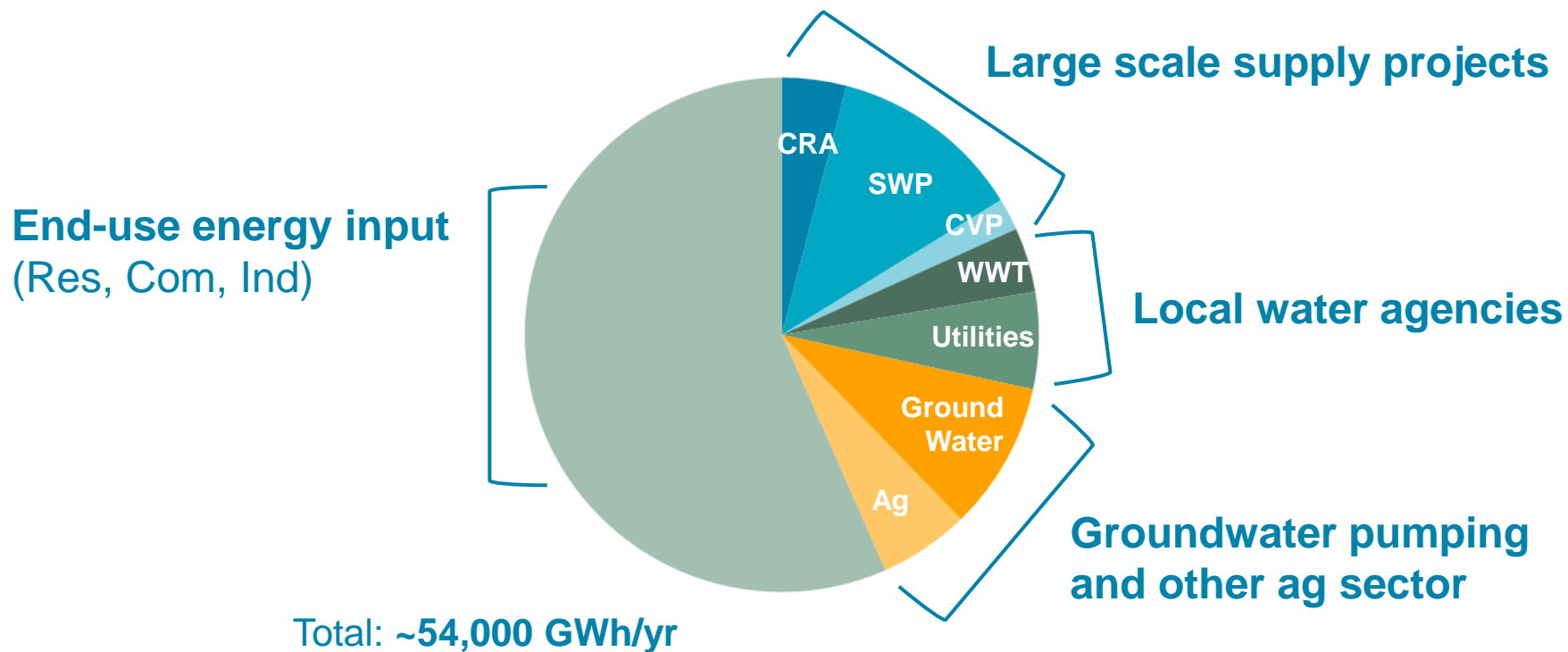
- **Energy/Water Savings Opportunities in Irrigated Agriculture**

Pete Canessa, Fresno State University Center for Irrigation Technology
Implementer of PG&E's Advanced Pump Efficiency Program (APEP)



The 19%

CA Statewide Annual Energy Demand Associated with Water Consumption





Three Levels of Water/Energy Efficiency



Type of measure	Example opportunities
1. Energy savings <i>associated with water</i>	<ul style="list-style-type: none">• Efficient water heater
2. <i>Combined water and energy savings for end user</i>	<ul style="list-style-type: none">• Low flow showerhead
3. Water conservation <i>only (upstream/ embedded energy)</i>	<ul style="list-style-type: none">• High efficiency toilet



PG&E Water/Energy Program Examples

PG&E portfolio addresses several areas of water/energy

	Deemed EE Products (Prescriptive Savings)	Custom EE Products (Calculated Savings)	Demand Response & Distributed Gen
Residential	Clothes washers Water heaters	N/A	Solar water heating
Commercial	Ozone laundry Low flow faucet aerators Steam Traps	Waste water treatment Condensing boilers	Water utility auto-DR Wastewater plant self gen
Industrial	Pipe Insulation Boilers and steam systems	Steam leaks Pump VFDs	Pressure reduction turbines
Agricultural	Low flow sprinkler nozzles Sprinkler to drip conversion	Pump Efficiency Program	Ag Pump auto-DR

Rebates/incentives determined based on facility level energy savings (not embedded)



PG&E Energy Efficiency Channels

Sectors where water usage occurs:

- Water utilities
- Wastewater treatment
- Ag producers
- Food processing
- Industrial
- Residential
- Multifamily
- Large commercial
- Small commercial

PG&E energy efficiency channels:

- Direct sales
- Midstream/upstream
- Trade alliances
- 3rd party partners
- Government partners

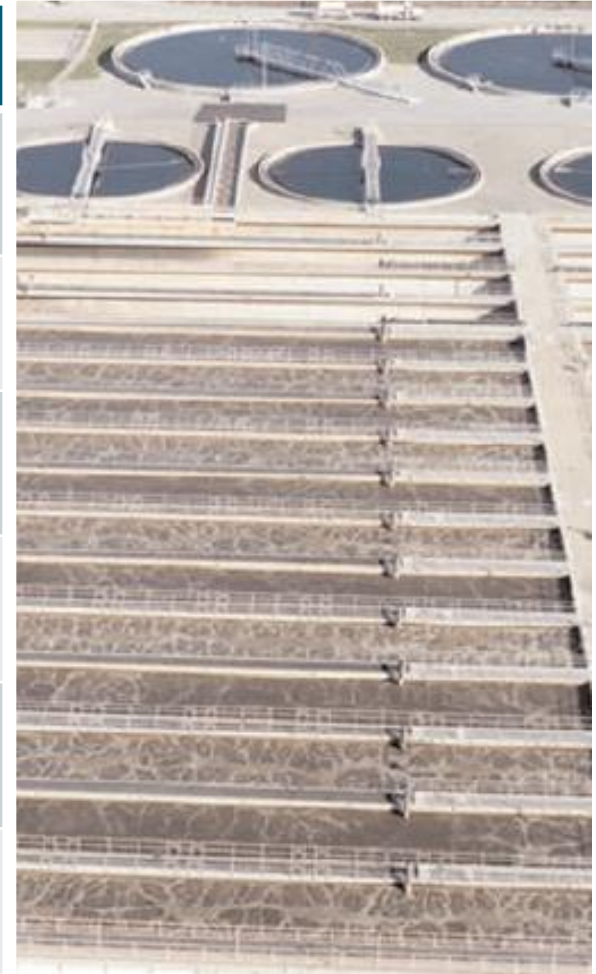
Example Programs:

- Customized retrofit/new construction
- Appliance retailers
- Various opportunities provided by Trade Pro partners
- Wastewater program
- Ozone laundry program
- Food processing program
- Local government partnerships



PG&E Solutions for Water & Wastewater facilities

Service offering	Description
Energy Audits	Analysis of energy usage and identify potential energy savings opportunities
Energy Efficient Retrofits	Rebates and Incentives for installing energy efficient measures and processes
Energy Efficient New Construction	Resources and incentives for energy efficient design and construction
Demand Response	Incentives for voluntary, temporary load reduction during peak demand periods
Solar and other Self-Generation	Rebates for installation of qualified generation systems
On Bill Financing (OBF)	No-interest loans available to eligible customers for energy efficient retrofit projects that are repayable through PG&E bills



PG&E also offers additional services such as Pricing Plans and Benchmarking that enable customers to understand their energy usage and rates to determine any changes to the facility operation and/or pricing plans



Water Agency Partnerships

- Collaborative Rebate Programs
 - Example: PG&E/BAWSCA Clotheswashers Program
 - Bay Area Regional Residential Clotheswasher Rebate Program
 - \$50/washer from PG&E along with \$50-100 from participating agencies
- Facility Audits: combine energy audits with water agency audits
- Leak Repair Projects
 - Projects can use custom retrofit and retro-commissioning platforms
- Embedded Energy Programs
 - Example: Low Flow Toilets Pilot
 - SCVWD Pilot Project (2009 program)
 - Direct install program targeting low income customers
 - UC Davis analysis of EBMUD embedded energy (*in progress*)
 - Spatial and temporal analysis of 2007-2012 data
 - Identify opportunities to focus programs on “hot spots”
 - Provide basis for partnerships with more agencies

Richard Harris

**Manager of Water Conservation,
East Bay Municipal Utility District (EBMUD)**



Water/Energy Nexus Strategies



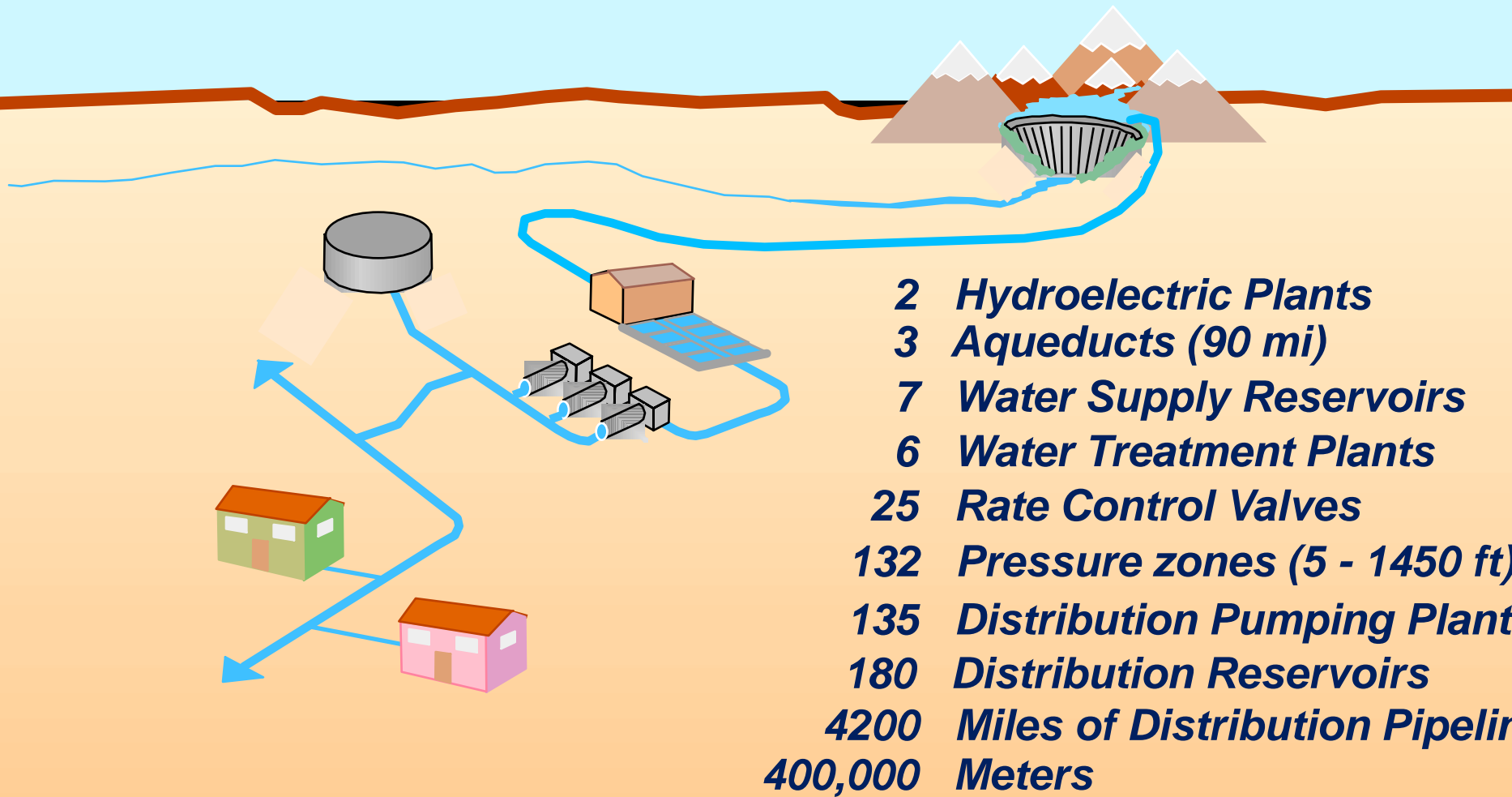
Overview



- EBMUD Energy Management
- EBMUD and PG&E Partnering
- W/E Technology Deployment Synergies
- Challenges & Opportunities



EBMUD Water System Facilities



~ 1.34 million customers

~ 180 MGD Production

Wastewater Cogeneration

- Renewable energy production doubled from 2 MW to 4.5 MW
- Power plant capacity expansion to 11 MW will be completed in 2010
- 2012 - “Net energy producer” generating more renewable electricity onsite than required for demand.



Energy Management Strategy

- Water Conservation
- Energy Management Strategy
 - Diversify Energy Supplies
 - Minimize Energy Use
 - Minimize Energy Costs
 - Education and Information Sharing
- Ensure that energy related projects are prioritized based on best overall cost savings



EBMUD Energy Use (kWh/MG)



Water System	Normal Year	Dry Year
Supply/Conveyance	177	1,423
Treatment	156	1,610
Distribution	917	917
TOTAL	1,250	3,950

- Dry Year Scenario: Includes Mokelumne supply, supplemental water supply, desalination, groundwater and recycled water
- Gravity Water Customers (55%)= ~ 400 kWh / MG
- Pumped Water Customers (45%) ~ 2000 kWh/ MG

EBMUD – PG&E Partnerships



- Water/energy rebate for clotheswashers
- Joint customer water/energy audits/referral program
- Joint research with FSTC
 - Ice machines
 - Connectionless Steamers
 - Pre-Rinse Spray Valves
- Energy rebates for utility scale projects (PV, micro-turbines, biodiesel, in-conduit hydro)

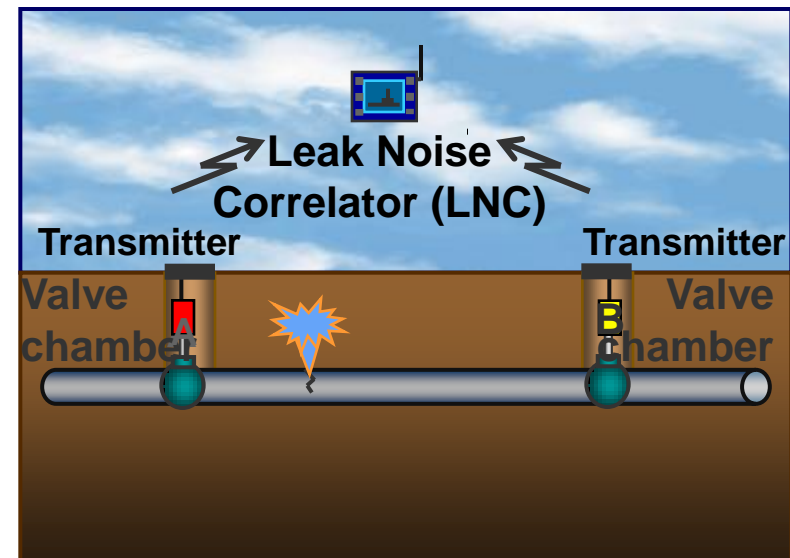
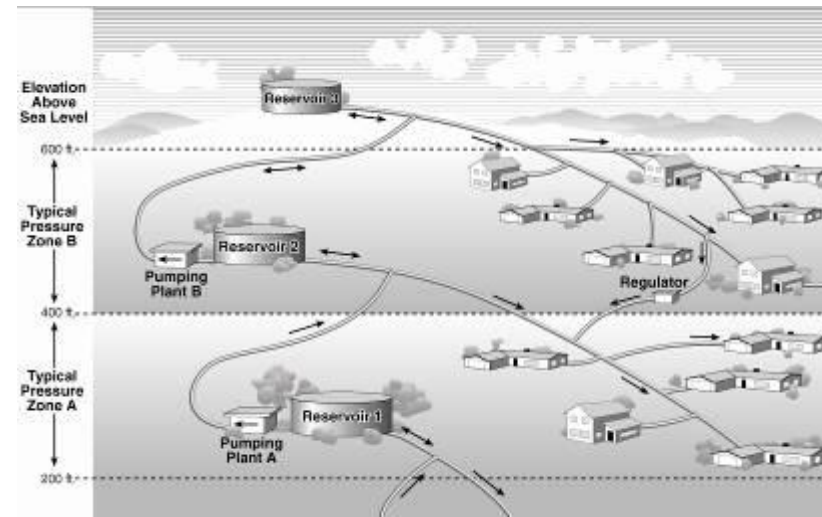


W/E Technology Deployment Synergies

Distribution System Applications

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2013

- Demand management:
 - Off peak pumping
 - Water treatment optimization
 - Better facility sizing
- Water Loss Control
 - Leak detection
 - Pressure management

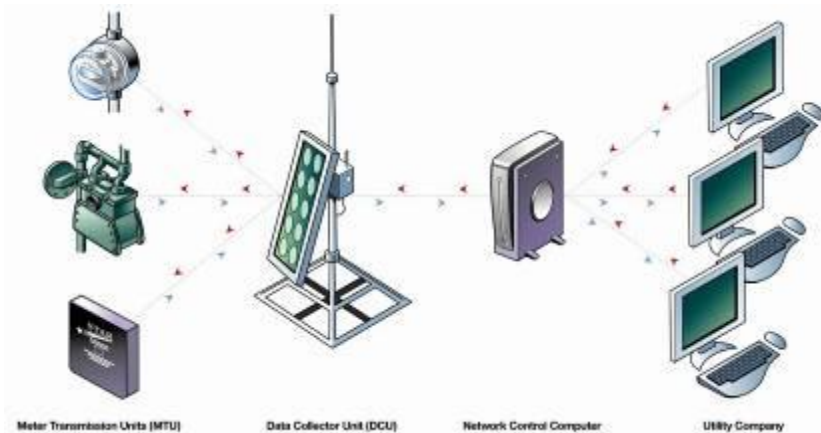


W/E Technology Deployment Synergies

Smart Metering Infrastructure

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2013

- Potential to share/integrate infrastructure and/or services
- Provide customers with integrated website/usage reports
- Pursue water/energy and embedded energy savings



EBMUD WaterSmart Toolbox

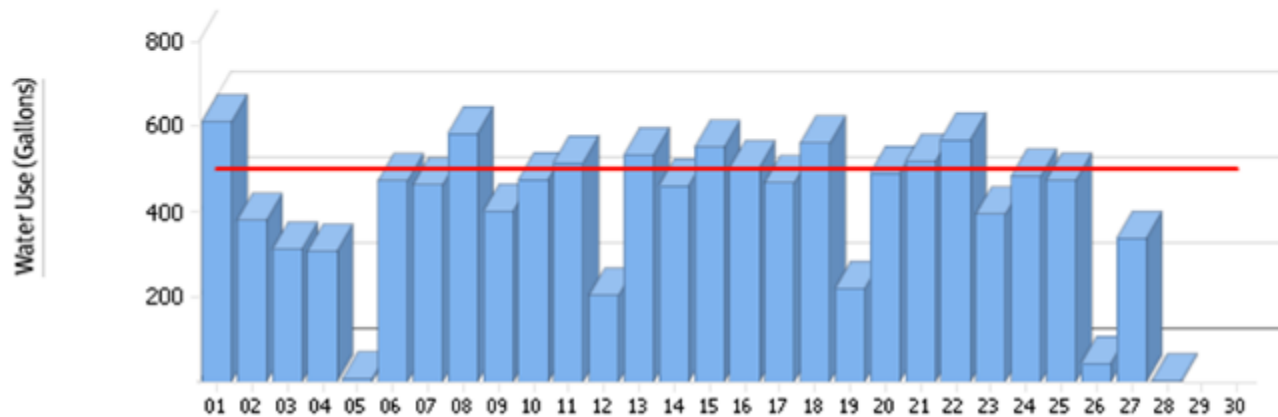
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User Lookup

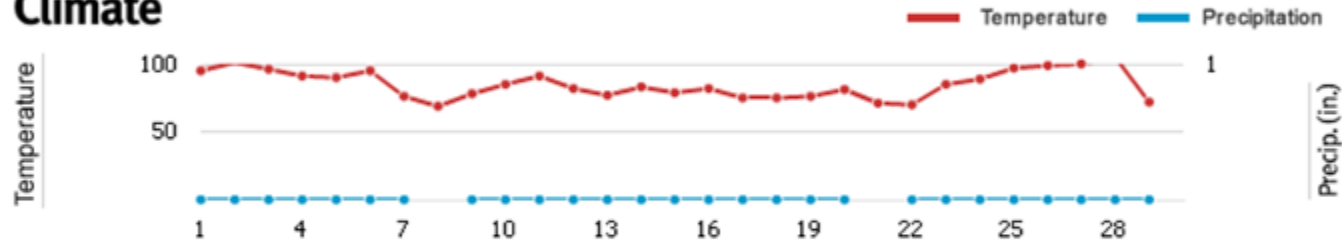
Account #123452

Daily Water Usage

Daily usage for September 2010



Climate



Quick View

Yearly Monthly **Daily** Hourly

[Table View](#)

Climate

☒ Temperature ?

☒ Precipitation ?

Settings

[Edit](#)

Daily Limit: **ON**

Alert sent at 500 Gallons

Leak Detection: **ON**

Threshold set at 10 Gallons

Download Report ?

Enter timeframe

Water Use:

Choose ...

DOWNLOAD

W/E Technology Deployment Synergies

End User Applications

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- **Food Service & Hospitality Sectors**

- Self-contained (connectionless) food steamers
- Commercial dishwashers
- Pre-rinse spray valves
- Air-cooled ice machines



- **Health Care/Medical Sector**

- X-ray film & photo processors
- Steam sterilizers



- **General Application**

- Weather-based irrigation controllers
- Hot water delivery systems
- Laundry equipment
- Car washing
- Gray water systems



W/E Technology Deployment Synergies

Landscape Irrigation Water Budgets

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2013



East Bay Municipal Utility District
Water Conservation Division
Maximum Allowable Water Budget

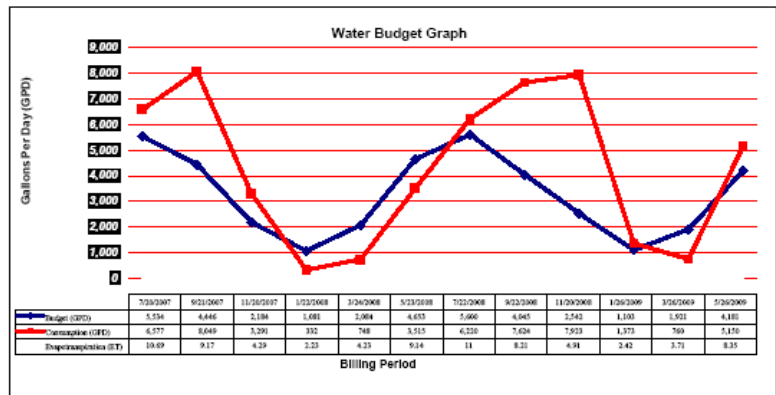
Thank you for participating in our Landscape Irrigation Water Budget Program. The following is your customized water usage profiles for the last two years. EBMUD records indicate that this account primarily serves landscape irrigation. The graphical description compares your measured water usage verse your budgeted water usage for each billing period.

Customer Name: [REDACTED]
Service Address: [REDACTED]
City: San Leandro
Account #: [REDACTED]
Meter #: [REDACTED]
Est. Irrigated Area (sq. ft.): 49,000



Water Budget Summary	Used	Budgeted
Gallons used last 12 months	1,743,000	1,178,973
Gallons used previous year	1,350,720	1,214,098

Percent of budget last 12 months	148%
Percent of budget for previous year	111%
2 year "irrigation season" estimated savings in dollars	\$ 3,342.76
2 year "irrigation season" estimated savings in gallons	960,142



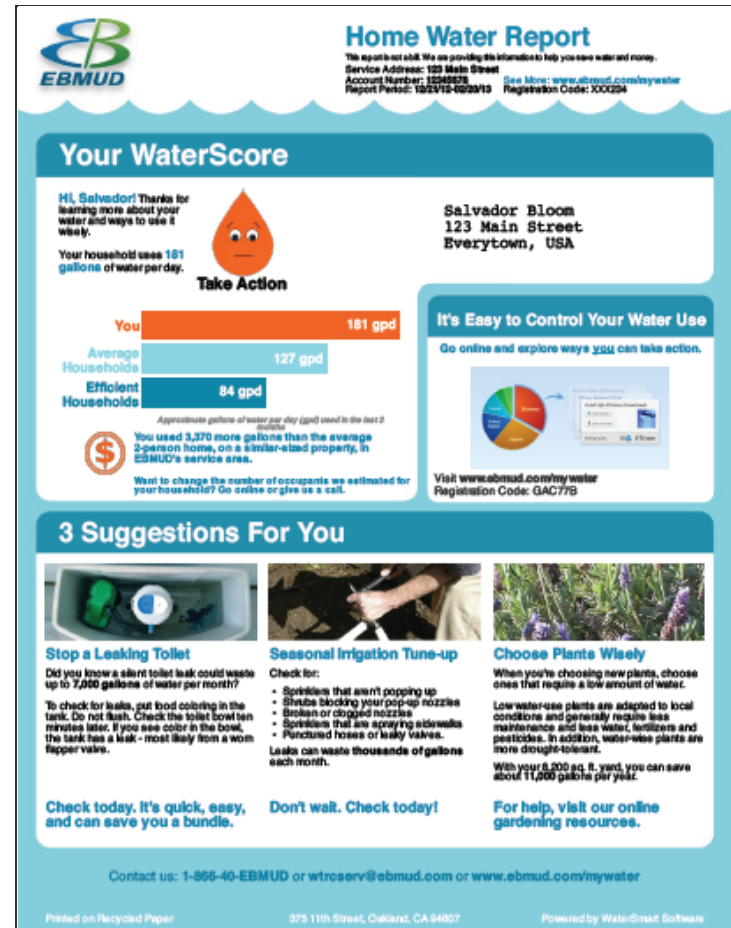
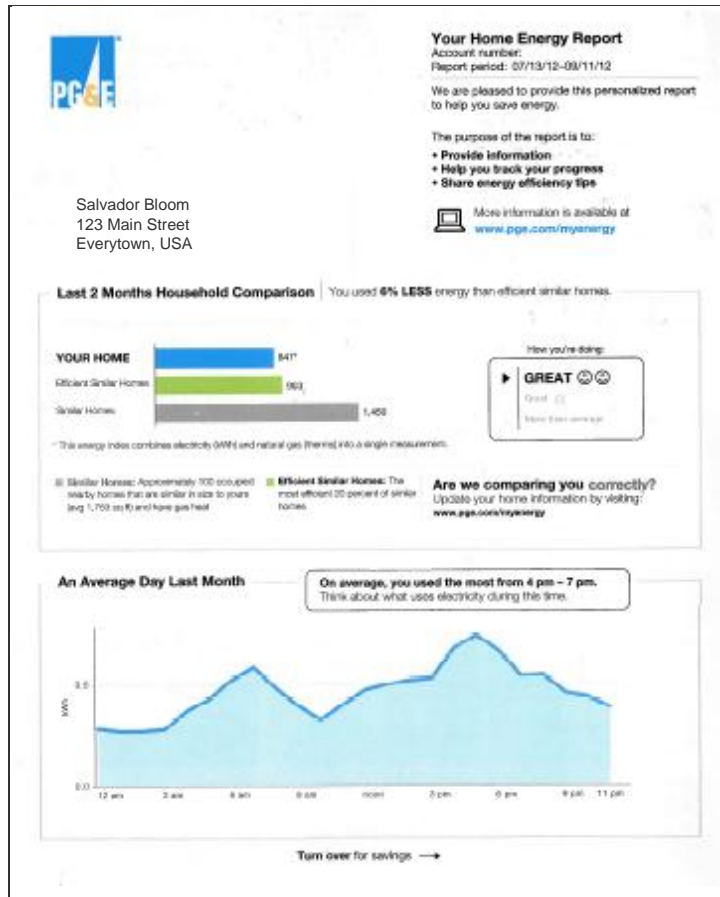
* ET = Represents the estimated water need of cool season grass (in inches) for each billing period. The Water Budget Calculation does not use rain, typically irrigation systems can be turned off for the winter months of November, December, January, and February. The Maximum Allowable Water Budget is calculated using 100% of Reference Evapotranspiration (ET₀) of the irrigated area for each billing period. If you feel the irrigated area is not accurate or would like more information on this program, contact EBMUD at 510 986-7615.

water
SMART

W/E Technology Deployment Synergies

Home Water-Energy Reports

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10th ANNUAL WATER CONSERVATION SHOWCASE



USGBC
NORTHERN
CALIFORNIA



Challenges and Opportunities



Challenges

- Need to address efficiency gains and GHG/carbon credits double counting perceptions
- Cost of energy sources from fossil fuel difficult for water utilities to control
- Differential in water and energy costs and ROI

Opportunities

- Advance utility, market and consumer awareness
- Improve and expand on W/E data collection and metrics
- Analyze and promote incentive funding for cold and hot water efficiency programs that save energy
- Expand public-private efficiency partnerships

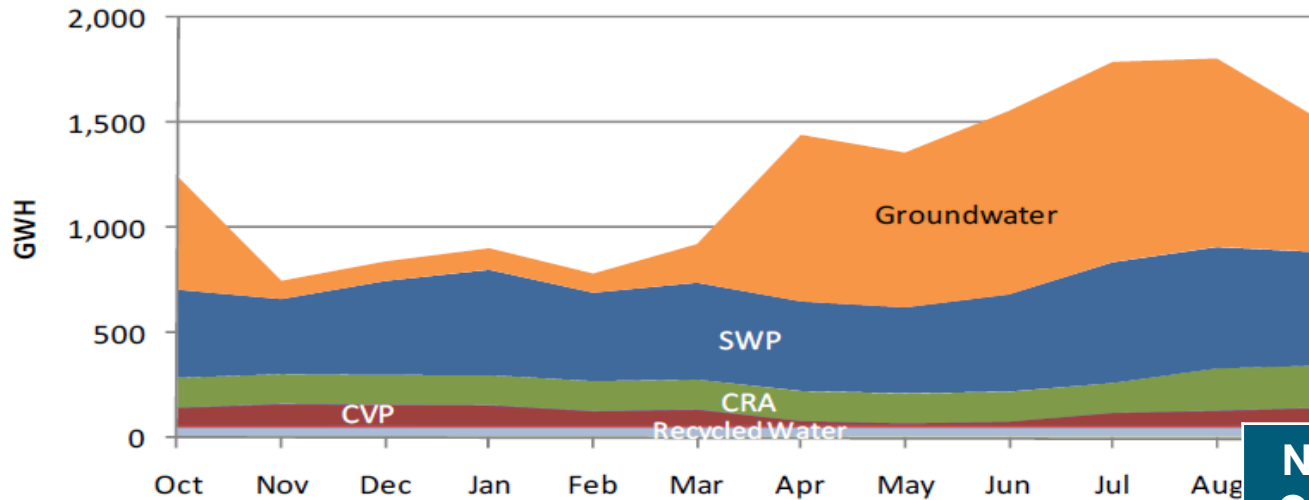




Demand Response Programs

Water suppliers are increasingly participating in DR programs

Monthly Energy Consumption in 2010 by California Water Supplies



* Chart from Navigant/GEI Study 1 for CPUC, 2010.

DR Program Participation:

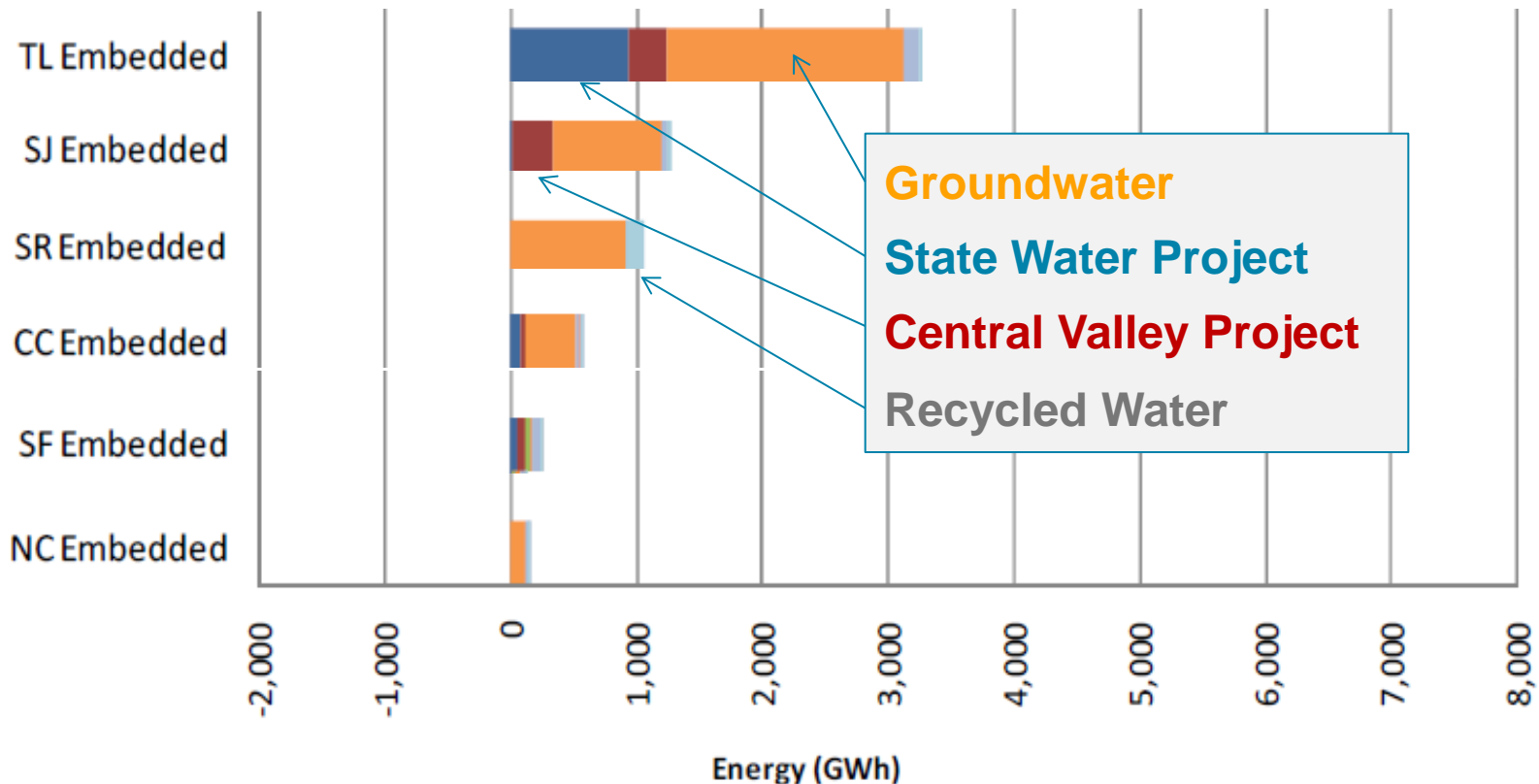
		Number of Customers	MW
Water District Customers	Current Customers	4	5.2
	2012 (in Process)	3	8.4
	TOTAL	7	13.6
Ag Pumping Customers	Current Customers	35	14.1
	2012 (in Process)	18	6.0
	TOTAL	53	20.1



Water/Energy Nexus in the Ag Sector

N. California embedded energy (water supply) driven mainly by groundwater pumping

2010 Physical and Embedded Energy by Supply and Region



* Modified chart based on Navigant/GEI Study 1 for CPUC, 2010.
Chart does not include energy used for water treatment and delivery (Study 2)



Water/Energy Nexus in the Ag Sector

Large energy usage for Ag pumping

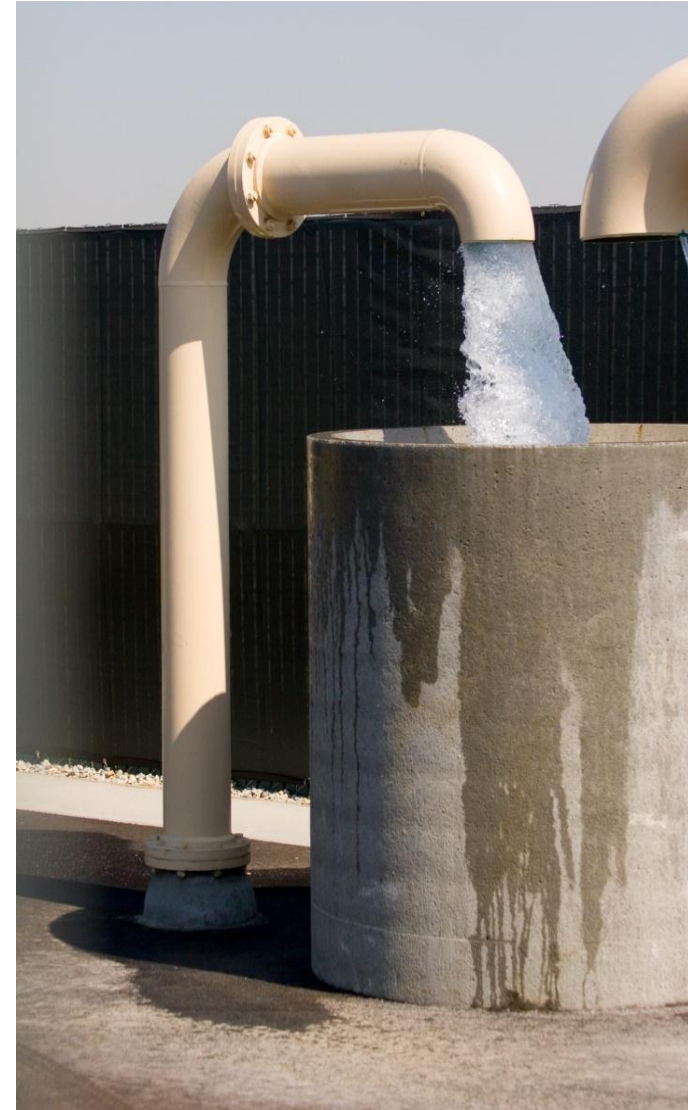
- Can be reduced through on-farm water conservation or pumping/distribution system improvement

PG&E Efficiency Programs

- Advanced Pump Efficiency Program
- Low pressure sprinkler nozzles
- Sprinkler to drip irrigation conversion
- Third party programs: Dairies, Wineries
- Training and education programs

Emerging Technologies projects:

- Combined energy & water irrigation evaluations
- Low pressure microdrip design
- Support of CSU-Fresno Ag/Water/Energy center



Peter Canessa

Center for Irrigation Technology
California State University, Fresno





*Pacific Gas and
Electric Company®*

Combined Pump Test / Irrigation System Evaluations

A Development Project
by

Center for Irrigation Technology
California State University, Fresno



*Pacific Gas and
Electric Company®*

Center for Irrigation Technology



What it is...

- ❑ Pilot Project – not open to public
- ❑ Intended to develop protocols and a reporting format that integrates:
 - Standard irrigation system evaluation
 - Standard pump efficiency test
- ❑ Identify costs and potential for a full-scale program



Annual Energy Use...

$$\text{kWh/Year} = \text{kWh/AF} \times \text{AF/Year}$$

kWh/AF – kiloWatt-hours required to pump an acre-foot through the system

AF/year – acre-feet of water pumped through the system each year



Further...

$$\text{kWh} / \text{AF} = 1.0241 \times \text{TDH} / \text{OPE}$$

Where:

TDH – total dynamic head in feet of water head

OPE – overall pumping efficiency as a decimal (0 – 1.0)



Saving Energy – Reduce kWh/AF...

- ☐ The pump efficiency test
 - Identifies Overall Pumping Efficiency
 - Provides pumping cost analysis
 - Measures TDH and discharge pressure of the pump – BUT...
 - ☐ Is the DP excessive or inappropriate for the system?
 - ☐ No analysis of piping system, valves, filters, etc.



Basic Irrigation Performance...

- Two main metrics
 - Distribution Uniformity – how evenly water is distributed across the field
 - Application Efficiency – how much of the water applied is beneficial use
- Two main relationships
 - Need good DU BEFORE good AE
 - Good DU is NO GUARANTEE of good AE



Saving Energy – Reduce AF/year...

- ☐ The irrigation system evaluation
 - Distribution Uniformity
 - ☐ Benchmark for improvement
 - ☐ Recommendations to achieve
- ☐ Overall Water Management (Seasonal Performance module)
 - DU first, but control of total application
 - ☐ Know how much has to be applied
 - ☐ Know how much has been applied



Extended evaluation protocol...

Added questions to address Water/Energy nexus...

- ☐ Demand response opportunities
- ☐ Potential for Variable Frequency Drive
- ☐ Irrigation scheduling opportunities



Added Opportunity w/ Combined Eval...

Reduce pressure (TDH) in the system

- ☐ Is the pump applicable to the system?
- ☐ Excessive filter losses
- ☐ Excessive regulating valve losses
- ☐ Overall piping design



By 9/30/2013...

- ☐ 45 combined pump test/system evaluations (most on fields that have been evaluated previously)
 - Development of simple, concise report format
 - Identify impact of irrigation system evaluations (do they conserve water?)
 - Will irrigators respond?
- ☐ Identify cost ranges for common recommendations – future EE measures
- ☐ Identify costs and achievable scale for full programmatic effort







Proposed initiatives for 2013-14

- Improve tracking of water savings associated with facility-level energy efficiency
- Expand scope of Large Integrated Audits to identify water savings
- Expand custom projects influencing water savings
 - Water delivery system efficiency opportunities
- Leak Repair / Pressure Management Initiatives
- Inform new programs through Emerging Technologies projects
 - Sprinkler and drip systems
 - Water utility efficiency potential
 - Embedded energy



Challenges to expanded water/energy programs

Barriers to implementation by end use customers and water utilities

- Water is often cheap or even free and/or unmeasured
- Ag users may lose water rights
- Risk aversion to new approaches
- First cost barriers and funding cycles
- Water/energy projects may have longer payback than other EE

Barriers to embedded energy or avoided cost of water program design

- Embedded energy variance – by customer type, location, year
- Water and Energy savings may happen at different locations/customers
- Cost effectiveness to IOU ratepayers for upstream savings

Policy questions:

- Eligibility of savings at non-IOU customers
- Appropriate simplifying assumptions for embedded energy calculations

Q&A

Further questions, please contact Sam Newman
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